TNE1520-P and TNE1520-S

T1 Loop Bonding Network Extender Provider and Subscriber

CAUTION Net to Net Technologies strongly recommends the use of proper electrostatic discharge (ESD) precautions when handling this equipment.

1.0 INSTALLATION

1.1 Unpack and Inspect the Equipment

The following components should be included:

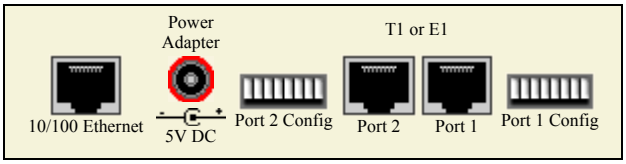
1 TNE1520
1 power supply

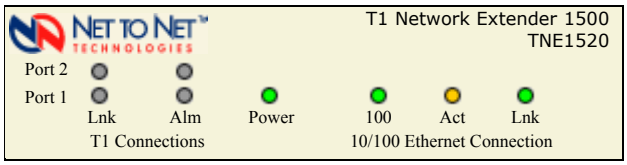
If there is any visible damage, do not attempt to connect the device. Contact Customer Support at 1-877-638-2638 (1-603-427-0600 for international customers) or support@nettonet.com .

1.2 Power Up the TNE1520

Plug the power supply into the power adapter port on the back of the TNE1520 and connect it to your power source. Verify that the Power LED on the front of the TNE1520 is illuminated.

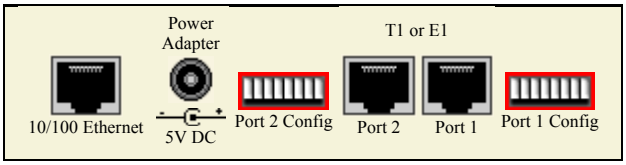
NOTE Upon start up, the Ethernet link will remain disabled (as indicated by solid illumination of the Ethernet 100, Act and Lnk LEDs) until at least one of the two T1 connections has been established.





1.3 Configure the T1 Ports

Configuration Switches for both T1 Port 1 and T1 Port 2 are numbered from left to right, #1-8.



	TNE1520-P PROVIDER CONFIGURATION SWITCHES		**TNE1520-S** SUBSCRIBER CONFIGURATION SWITCHES	
Switch	Port 1	Port 2	Port 1	Port 2
1 2	speed	speed	NOT USED: the TNE1520-S determines speed via communication with its partner T1 provider unit	
3	frame type	NOT USED: Port 2 frame type is determined by the Port 1 frame type configuration	frame type	NOT USED: Port 2 frame type is determined by the Port 1 frame type configuration
4	line code	NOT USED: Port 2 line code is determined by the Port 1 line code configuration	line code	NOT USED: Port 2 line code is determined by the Port 1 line code configuration
5 6	line attenuation	NOT USED: Port 2 line attenuation is determined by the Port 1 line attentuation configuration	line attenuation	NOT USED: Port 2 line attenuation is determined by the Port 1 line attentuation configuration
7	timing	NOT USED: Port 2 timing is determined by the Port 1 timing configuration	NOT USED: the TNE1520-S determines timing via communication with its partner T1 provider unit	
8	NOT USED	NOT USED	NOT USED	NOT USED

1.3.1 Speed

Ports 1 and 2, Switches #1 and #2: TNE1520-P ONLY

The T1 lines each have 24 channels continually running at 64 kbps for a collective bandwidth of 1,536 kbps. The timeslot configuration determines how many of the channels for each port will actually receive data. Ports configured to operate as fractional T1 lines require contiguous timeslots as indicated in the table below.

Port 1 Configuration Switches #1 and #2 on the TNE1520-P work in tandem with one another to provide four timeslot/bandwidth options for the Port 1 T1 link. Port 2 Configuration Switches #1 and #2 on the TNE1520-P provide the timeslot/bandwidth options for the Port 2 T1 link. The TNE1520-S determines timeslot and bandwidth configurations for the two T1 links via communication with its partner T1 provider unit.

Switch #1	Switch #2	Timeslots	Bandwidth (kbps)
down	down	1-24	1,536
up	down	1-18	1,152
down	up	1-12	768
up	up	1-6	384

1.3.2 Frame Type

Port 1 ONLY, Switch #3: both the TNE1520-P and the TNE1520-S

Frame type is the T1 data encapsulation method. A frame consists of 193 bits (8-bit samples of each of the 24 T1 data channels plus a synchronization bit) transmitted at a rate of 8,000 frames per second (1,536 kbps) across the T1 line.

1.3.2.1 Extended Super Frame

Extended Super Frame (ESF) format, used in Wide Area Networks (WANs), assembles data into 24-frame transmission clusters and integrates the following:

1.3.2.1.1 Facilities Data Link
Facilities Data Link (FDL) provides in-service monitoring and diagnostics.

1.3.2.1.2 Cyclic Redundancy Check
Cyclic Redundancy Check (CRC) scrutinizes data integrity and detects line errors.

1.3.2.2 Super Frame
Super Frame (SF) format assembles data into 12-frame transmission clusters. SF does not utilize FDL or CRC.

Port 1 Configuration Switch #3 on the TNE1520-P and the TNE1520-S controls the frame type of BOTH T1 links (Port 1 and Port 2); frame type for the two links cannot be configured independently.

Switch #3	Frame Type
down	Extended Super Frame
up	Super Frame

1.3.3 Line Code
Port 1 ONLY, Switch #4: both the TNE1520-P and the TNE1520-S

Line code is the T1 mode of transmission. The two line code options outlined below fall within the International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) G.703 Standards for Transmission Facilities.

1.3.3.1 Bipolar with 8 Zero Substitution
Bipolar with 8 Zero Substitution (B8ZS) is used to accommodate the minimum ones desity requirement in the North American public network. B8ZS line encoding helps prevent loss of synchronization between the TNE1520 and remote T1 equipment by using bipolar violations to guarantee the presence of pulses in the T1 line.

1.3.3.2 Alternate Mark Inversion
Alternate Mark Inversion (AMI) simply alternates positive and negative pulses. Although AMI links typically encounter long strings of zeros which can potentially cause loss of synchronization between units, Net to Net Technologies' products meet the North American minimum ones density requirement internally such that, even with AMI, loss of synchronization is prevented between the TNE1520 and remote T1 equipment (just as it is with B8ZS).

Port 1 Configuration Switch #4 on the TNE1520-P and the TNE1520-S controls the line code of BOTH T1 links (Port 1 and Port 2); line code for the two links cannot be configured independently.

Switch #4	Line Code
down	Bipolar with 8 Zero Substitution
up	Alternate Mark Inversion

1.3.4 Line Attenuation
Port 1 ONLY, Switches #5 and #6: TNE1520-P ONLY

Shorter distances between the TNE1520-P and remote modems require increasing T1 transmit line attenuation in order to prevent the T1 signal from becoming too strong for repeaters, switches and other T1 transmission equipment that may be encountered along the line. Increased line attenuation translates to decreased T1 transmit amplitude.

1.3.4.1 0 dB

Receivers on most newer T1 transmission equipment can automatically adjust for incoming amplitude, allowing them to run at zero attenuation regardless of distance.

1.3.4.2 -7.5 dB, -15 dB, -22.5 dB

Some older T1 transmission equipment cannot automatically adjust for incoming amplitude and line attenuation must be set accordingly.

Port 1 Configuration Switches #5 and #6 on the TNE1520-P control the line attenuation of BOTH T1 links (Port 1 and Port 2); line attenuation for the two links cannot be configured independently.

Switch #5	Switch #6	Attenuation
down	down	0 dB
up	down	-7.5 dB
down	up	-15 dB
up	up	-22.5 dB

1.3.5 Timing

Port 1 ONLY, Switch #7: TNE1520-P ONLY

Timing refers to the clock source for T1 transmission links.

1.3.5.1 Local

Local clock source refers to timing derived from an oscillator onboard the TNE1520-P.

1.3.5.2 Loop

Loop clock source refers to timing derived from an intermediate device.

Port 1 Configuration Switch #7 controls the timing of BOTH T1 links (Port 1 and Port 2) on the TNE1520-P; timing for the two links cannot be configured independently. The TNE1520-S determines T1 timing via communication with its partner T1 provider unit.

Switch #7	Clock Source
down	Local
up	Loop

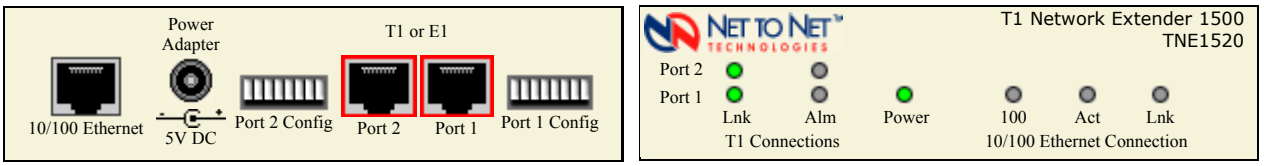
1.4 Connect the T1 Line(s)

The primary feature of the TNE1520 is loop bonding capability, although both the provider and subscriber units are able to function with a single T1 connection as well.

1.4.1 Loop Bonded Connection

Using two T1 lines for one network connection (loop bonding) will net twice the speed and data passing capability as a single T1 connection. A second T1 line can also be considered a backup for the first, and vice versa, should one of the lines become disabled. A TNE1520 can only establish loop bonded connections with other Net to Net loop bonding capable T1 equipment. See Net to Net's T1 Loop Bonding Product to Product Feature Compatability list.

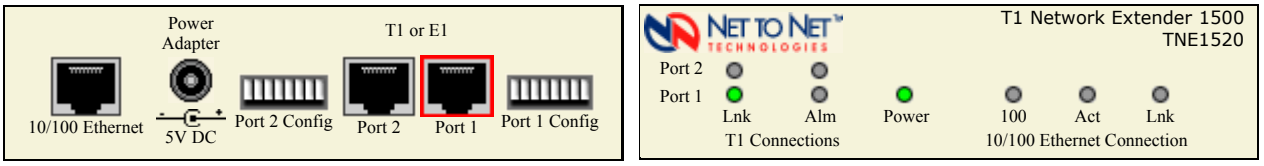
Plug the T1 cables into the T1 RJ45 ports (Port 1 and Port 2) on the back of the TNE1520; the order of connection is not important. Verify both connections: the Port 1 and Port 2 Lnk LEDs on the front of the TNE1520 will pulse green to indicate the connections are established and operational.



1.4.2 Single T1 Connection

A single line connection can be established between a TNE1520-P and any of Net to Net's T1 subscriber units, regardless of loop bonding capability. Likewise, a single line connection can also be established between an TNE1520-S and any of Net to Net's T1 provider units, regardless of loop bonding capability.

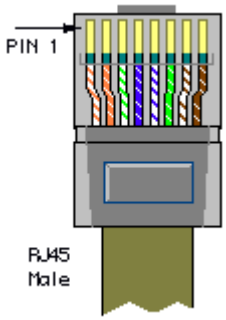
Plug the T1 cable into one of the two T1 RJ45 ports on the back of the TNE1520; either port (Port 1 or Port 2) may be used. Verify the connection: the T1 link LED on the front of the TNE1520 (Port 1 Lnk or Port 2 Lnk depending upon which port was connected) will pulse green to indicate the connection is established and operational.



1.4.3 T1 RJ45 Pinout

If you are using a shielded T1 cable for your network connection, it must be grounded through pins 3, 6, 7 and 8.

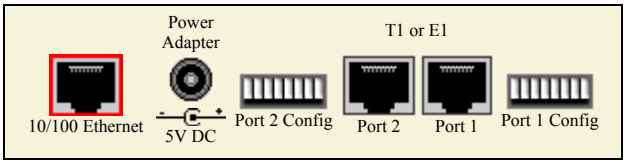
T1 RJ45 PINOUT			
Pin 1	Rx Ring	Pin 5	Tx Tip
Pin 2	Rx Tip	Pin 6	not used
Pin 3	not used	Pin 7	not used
Pin 4	Tx Ring	Pin 8	not used

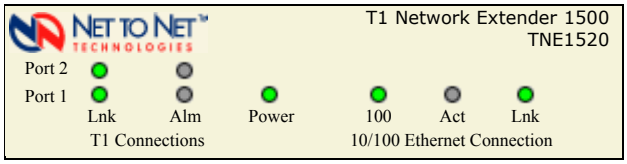


1.5 Connect the Ethernet Line

The 10/100 Ethernet Port auto-negotiates speed and duplex mode in accordance with the remote equipment to which it's connected; Ethernet speed and duplex mode configurations cannot be hard set on the TNE1520. For the best connection results, the remote device (PC, hub, switch, etc.) should be set to auto-negotiate speed and duplex mode as well. If the remote device cannot be configured to auto-negotiate, speed may be hard set at either 10 Mbps or 100 Mbps but duplex mode must be hard set to Half Duplex; a 10/100 Ethernet connection will not operate properly if the remote device is hard set to Full Duplex.

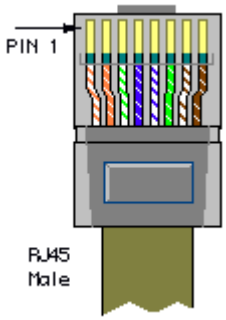
Plug the Ethernet cable into the 10/100 Ethernet Port on the back of the TNE1520. Verify the connection: solid green illumination of the 10/100 Ethernet Connection Lnk (Link) LED on the front of the TNE1520 indicates a connection has been established. If the Ethernet Lnk LED is illuminated but not the Ethernet 100 LED then a 10 Mbps connection has been established. If the Ethernet Lnk AND 100 LEDs are both illuminated, then a 100 Mbps connection has been established.





For most applications, the TNE1520 connects to a PC using a straight-through Ethernet cable and to a hub or a switch using a crossover Ethernet cable. For any other connection combinations you must verify the pinout of the Ethernet device to which you are connecting the TNE1520 in order to determine which type of cable is required.

ETHERNET RJ45 PINOUT			
Pin 1	Rx+	Pin 5	not used
Pin 2	Rx-	Pin 6	Tx-
Pin 3	Tx+	Pin 7	not used
Pin 4	not used	Pin 8	not used



2.0 ADDITIONAL INFORMATION

2.1 LED Indications

LED	State	Indication	Additional Information
T1 Connections Lnk (Port 1 and Port 2)	flashing green	T1 connection is established and active	Traffic is flowing.
	solid green	problematic T1 connection	A connection exists but there is indication of a problem with the T1 line.
	no illumination	**Red Alarm** The incoming connection to the unit has been lost; no data is being received.	If the outgoing connection from the unit has also been lost then the unit's partner TNE1520 will be in Red Alarm as well; **see NOTE on following page.**
T1 Connections Alm (Port 1 and Port 2)	no illumination	T1 is operational	An established T1 link has no alarm indications and is operational unless the T1 Lnk LED remains unlit as well, in which case the TNE1520 is in Red Alarm.
	solid amber	**Yellow Alarm** The outgoing connection from the unit has been lost; no data is being transmitted.	The unit's partner TNE1520 has lost its incoming connection and is in Red Alarm; **see NOTE on following page.**

	pulsing amber	**Blue Alarm** An indirect connection has been lost; the unit may no longer be receiving data from its partner TNE1520.	The unit's partner TNE1520 has lost a connection with an intermediate device and is in Red or Yellow Alarm; **see NOTE below.**
Power	solid green	TNE1520 is operational	If the Power LED is not illuminated, it is unlikely that the TNE1520 is receiving power and therefore none of the LEDs will be illuminated.
10/100 Ethernet Connection 100	solid green	100 Mbps Ethernet connection is established	If the Ethernet 100 LED is illuminated, the Ethernet Lnk LED will also be illuminated. A solid green Ethernet 100 LED can also signify a T1 Alarm; **see NOTE below.**
	no illumination	no 100 Mbps Ethernet connection	If the Ethernet 100 LED remains unlit but the Ethernet Lnk LED is illuminated then a connection has been established at 10 Mbps rather than 100 Mbps.
10/100 Ethernet Connection Act	pulsing amber	standard operation	Traffic is flowing without any problems.
	solid amber	heavy traffic	A solid amber Ethernet Act LED can also signify a T1 Alarm; **see NOTE below.**
	no illumination	no activity	Either there is no Ethernet link or a link exists but there is no activity.
10/100 Ethernet Connection Lnk	solid green	Ethernet connection is established	If the Ethernet Lnk LED is illuminated but not the Ethernet 100 LED then a 10 Mbps connection has been established. If the Ethernet 100 LED is also illuminated, then a 100 Mbps connection has been established. A solid green Ethernet Lnk LED can also signify a T1 Alarm; **see NOTE below.**
	no illumination	no Ethernet connection	The Ethernet 100 and Act LEDs will remain unlit by default.

(A pulsing LED blinks steadily at a rate of once per second. A flashing LED blinks at a more rapid, less constant rate.)

NOTE Whenever BOTH TNE1520 T1 connections have lost link and/or are experiencing T1 Alarm, the Ethernet link will automatically be disabled (as indicated by solid illumination of the Ethernet 100, Act and Lnk LEDs). Upon reestablishment of at least one of the T1 connections, the Ethernet link will be reinstated and the Ethernet LEDs will reflect current Ethernet Status.

2.2 Regulatory Compliance

2.2.1 US Federal Communications Commission (FCC)

2.2.1.1 Class B Equipment

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses, generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this

equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase separation between the equipment and the receiver
- Connect equipment to an outlet on a circuit different from the receiver
- Consult the dealer or an experienced radio/TV technician for help

2.2.1.2 T1 Equipment

Note: This equipment complies with Part 68 of the FCC rules and bears a label that contains the FCC registration number. This information must be provided to the telephone company if requested. This equipment should be connected to the telephone network or premise wiring using compatible modular plugs and cabling in compliance with the requirements of Part 68 of the FCC rules, using the following standard jack types:

- RJ-48H: TNE1500-P-12-XX or TAM1500-12
- RJ-48C: TNE1500-X, TNE1520-X, UIM-T1 or UIM-2T1

In the unlikely event that this equipment harms the telephone network, the telephone company can temporarily disconnect your service. The telephone company will try to warn you in advance of any such disconnection, but if advance notice isn't practical, it may disconnect the service first and notify you as soon as possible thereafter. In the event such a disconnection is deemed necessary, you will be advised of your right to file a complaint with the FCC. Additionally, the telephone company may, from time to time, make changes in its facilities, equipment, or operations that could affect the operation of this equipment. If this occurs, the telephone company is required to provide you with advance notice so you can make the modifications necessary to maintain uninterrupted service.

Caution: This unit does not contain any user serviceable parts. Repair service and/or warranty information may be obtained by contacting Customer Support at Net to Net Technologies, Inc.:

- Address: 112 Corporate Drive, Portsmouth, NH 03801
- Phone: (603) 427-0600 / (877) 638-2638
- Email/Website: www.nettonet.com

2.2.2 Industry Canada

2.2.2.1 Class B Equipment

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la Classe B est conforme à la norme NMB-003 du Canada.

2.2.2.2 T1 Equipment

Notice: The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational, and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements documents. The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment

malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas. Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

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